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Toxic metals in East African agro-ecosystems: Key risks for sustainable food production

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Toxic metals in East African agro-ecosystems: Key risks for sustainable food production

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Abstract

The dramatic increase in world population underpins current escalating food demand, which requires increased productivity in the available arable land through agricultural intensification. Agricultural intensification involves increased agrochemicals use to increase land productivity. Increased uses of agrochemicals pose environmental and ecological risks such as contamination and water eutrophication. Consequently, toxic metals accumulate in plant products, thus entering the food chain leading to health concerns. To achieve this study, secondary data from peer-reviewed papers, universities, and government authorities were collected from a public database using Tanzania as a case study. Data from Science Direct, Web of Science, and other internet sources were gathered using specific keywords such as nutrient saturation and losses, water eutrophication, potentially toxic metal (PTEs), and impact of toxic metals on soils, water, and food safety. The reported toxic metal concentrations in agro-ecosystem worldwide are linked to agricultural intensification, mining, and urbanization. Statistical analysis of secondary data collected from East African agro-ecosystem had wide range of toxic metals concentration such as; mercury (0.001–11.0 mg Hg/kg), copper (0.14–312 mg Cu/kg), cadmium (0.02–13.8 mg Cd/kg), zinc (0.27–19.30 mg Zn/kg), lead (0.75–51.7 mg Pb/kg) and chromium (19.14–34.9 mg Cr/kg). In some cases, metal concentrations were above the FAO/WHO maximum permissible limits for soil health. To achieve high agricultural productivity and environmental safety, key research-informed policy needs are proposed: (i) development of regulatory guidelines for agrochemicals uses, (ii) establishment of agro-environmental quality indicators for soils and water assessment to monitor agro-ecosystem quality changes, and (iii) adoption of best farming practices such as split fertilization, cover cropping, reduced tillage, drip irrigation to ensure crop productivity and agro-ecosystem sustainability. Therefore, robust and representative evaluation of current soil contamination status, sources, and processes leading to pollution are paramount. To achieve safe and sustainable food production, management of potential toxic metal in agro-ecosystems is vital.

Keywords

Agro-ecosystem; Eutrophication; Health risk; Pollution risk; Toxic metals; Toxic metal accumulation